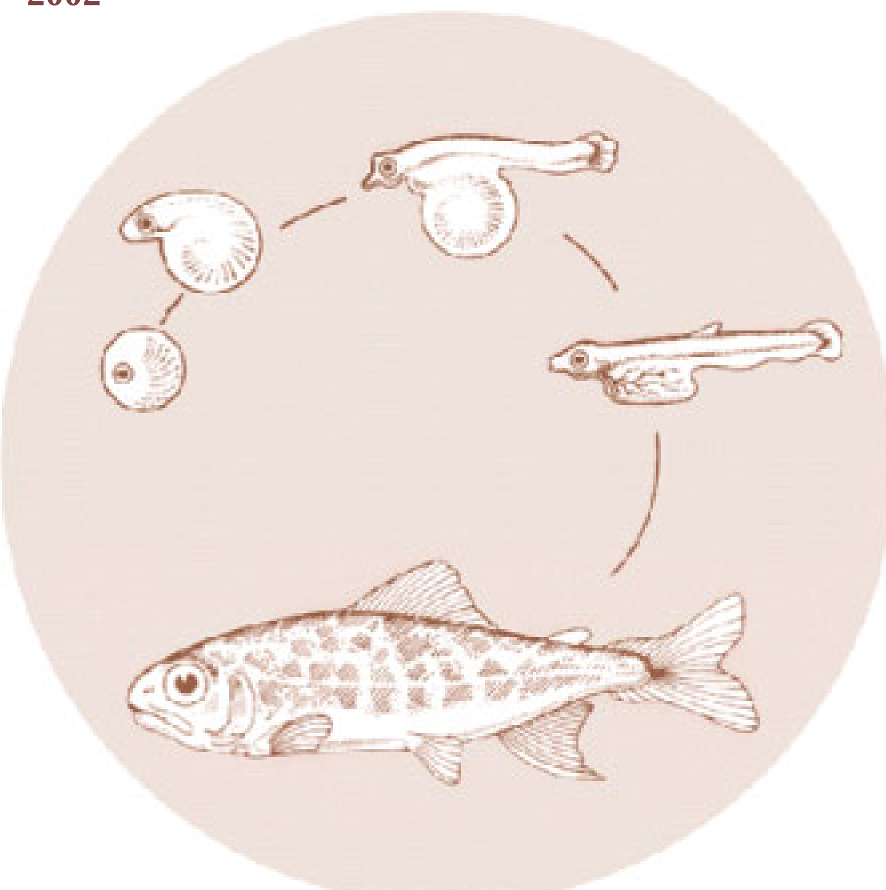
Monitoring and Evaluation for Grande Ronde Spring Chinook Salmon Program

Annual Report
2002



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Monitoring and Evaluation for Grande Ronde Spring Chinook Salmon Program

Annual Report

January 1, 2002 through December 31, 2002

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EXECUTIVE SUMMARY

This is the fifth annual report of a multi-year project to operate adult collection and juvenile acclimation facilities on Catherine Creek and the upper Grande Ronde River for Snake River spring chinook salmon. These two streams have historically supported populations that provided significant tribal and non-tribal fisheries. Conventional and captive broodstock supplementation techniques are being used to restore spring chinook salmon fisheries in these streams.

Statement of Work Objectives for 2002:

1. Plan for, administer, coordinate and assist comanagers in GRESCP M&E activities.

2. Evaluate performance of supplemented juvenile spring chinook salmon.

3. Evaluate life history differences between wild and hatchery-origin (F_1) adult spring chinook salmon.

4. Describe life history characteristics and genetics of adult summer steelhead collected at weirs.

Accomplishments and Findings for 2002

Prior to 2002, this project included both O&M (operations and maintenance) and M&E (monitoring and evaluation) components. Beginning in 2002, project O&M responsibilities were removed and placed in a separate project (BPA Project 9800703, BPA Contract No. 0006509, CTUIR Project 410), with a separate budget and reporting requirements. We report here the spring chinook monitoring and evaluation and summer steelhead life history components (BPA Project 9800703, BPA Contract No. 0006509, CTUIR Project 413).

A total of 180,912 Catherine Creek spring chinook salmon smolts were acclimated from February 26-April 15, 2002 (forceout), and 151,846 upper Grande Ronde River smolts from February 28-April 15, 2002 (forceout). Fish at both facilities were allowed to leave volitionally beginning on April 1, 2002. Mean fork lengths at tagging (October 1-16, 2001) of PIT-tagged fish were 115.2 mm (n=20,796) for Catherine Creek fish and 112.0 mm (n=1,491) for upper Grande Ronde River fish. Median arrival date of 3,061 PIT-tagged acclimated fish to Lower Granite Dam (expanded for spill) from Catherine Creek was May 17, 2002. Median arrival date of 213 PIT-tagged acclimated fish to Lower Granite Dam (expanded for spill) from the upper Grande Ronde River was May 18. Minimum cumulative detection rates of PIT-tagged fish were 32.6% for Catherine Creek (n=6,783 of 20,796) originally delivered) and 34.4% for upper Grande Ronde River fish (n=514 of 1,496 originally delivered).

Volitionally-released PIT-tagged fish totaled 38.4% of the estimated number of PIT-tagged fish delivered to the Catherine Creek facility and 45.5% of the upper Grande Ronde River fish. Peak numbers of PIT-tagged fish leaving both facilities occurred on April 13. Mean for length at PIT-tagging of volitionally-released Catherine Creek fish was 1.7 mm greater than force-out fish. Mean fork length at PIT-tagging of volitionally-released upper Grande Ronde River fish was 1.1 mm greater than force-out fish. Median arrival date to Lower Granite Dam was May 15 for n=1,237 volitionally-released (estimated) fish, compared to May 19 for n=771 force-out fish from Catherine Creek. Minimal cumulative unique detection rates were for volitionally-released (34.1%) and forceout (34.5%) fish from the upper Grande Ronde River facility. Minimal cumulative unique detection rates were 34.0% for volitionally-released and 33.0% for forceout fish from the Catherine Creek facility.

Brood year 2000 spring chinook salmon captive brood progeny released into the upper Grande Ronde River in October 2001 had a mean fork length at PIT-tagging of 112.7 mm (n=500), median arrival date at Lower Granite Dam of May 12, 2002, and a minimum cumulative detection rate of 20.8%.

Brood year 2001 spring chinook captive brood progeny released into Sheep Creek (tributary of the upper Grande Ronde River that enters between the acclimation and adult collection sites) on May 29, 2002 totaled 32,803 fish weighing 241.2 kg (136.0 fish/kg).

Adult salmonid traps were operated on Catherine Creek and the upper Grande Ronde River near La Grande, Oregon during 2002. The Catherine Creek weir was operated from March 12-August 13, 2002. The upper Grande Ronde River weir was operated from April 22-July 24, 2002. Life history data were collected from summer steelhead and spring chinook salmon. A portion of the spring chinook salmon trapped from each stream were kept for broodstock, transported to Lookingglass Hatchery and held in ponds, and spawned in August and September.

Two hundred fifty-nine unmarked (wild) summer steelhead (including fallbacks) were collected at the Catherine Creek weir from March 14 to July 24, 2002. Mean FL for 151 females was 619.5 mm, and for 106 males was 642.7 mm. One ad-clipped (hatchery-origin) fish was collected. The age composition of 226 fish was 1-ocean, 77.3% and 2-ocean, 22.7%. Thirteen fish were fallbacks, and eight of these had been previously caught at the trap and marked before being passed upstream. The estimated number of fish spawning above the weir was 398 (95% confidence intervals 253-543).

Sixty-three unmarked (wild) summer steelhead (including fallbacks) collected at the upper Grande Ronde River weir from April 24 to June 14, 2002. Mean FL were 638.3 mm for 25 males and 632.7 mm for 38 females. Thirty-six fallbacks were recovered and nine of these had been previously caught at the trap and marked before being passed upstream. The estimated number of fish spawning above the weir was 137 (95% confidence intervals 78-196).

One-hundred and seventy unmarked and 142 marked (ad-clipped) adult spring chinook salmon (first time captures) were collected at the Catherine Creek weir from May 20 to July 31, 2002. Mean FL of unmarked fish was 734.1 mm and for marked fish was 691.4 mm. Age composition of unmarked fish estimated from an age-length key was 7.4% age 3, 82.3% age 4, and 10.3% age 5. Marked fish were ages 3 and 4. First-time captures of unmarked adult spring chinook salmon at the upper Grande Ronde River weir totaled 102 during May 30 to July 13, 2002. Three marked (ad-clip) fish were caught during the same period. Mean FL of unmarked fish was 751.0 mm and for marked fish was 718.0 mm. Age composition of unmarked fish was 3.9% age 3, 80.4% age 4, and 15.7% age 5. Marked fish were age 4. Mean fecundities of 13 Catherine Creek and 25 upper Grande Ronde River females spawned at Lookingglass Hatchery were 4,451 and 3,955 eggs/female, respectively.

Spawning ground surveys on Catherine Creek (carcass recoveries) showed hatchery-origin fish spawned during the same time period and in the same areas as wild (unmarked) fish. In addition to the regular spawning ground surveys conducted with comanagers, 8 additional spawning ground surveys were conducted on selected reaches of Catherine Creek, the upper Grande Ronde River, and Sheep Creek from July 23-September 18 and yielded an additional 19 spring chinook carcasses. Additional spawning ground surveys (above the 3 regularly scheduled) may provide valuable adult life history information.

Juvenile life histories of hatchery-origin spring chinook have shown minor variations in migration timing, size, and minimum survival to Lower Granite Dam. Hatchery-origin fish have been larger at migration and had higher minimum survival to Lower Granite Dam than wild fish.

The weirs trapped 61% and 89 %, respectively, of the 2002 estimated spawners migrating above the Catherine Creek and upper Grande Ronde River weirs. The low percentage of fish collected from Catherine Creek probably resulted from ineffective weir functioning due to high flows and debris loads. Ineffective weir functioning means broodstock selection is not occurring across the run.

Program assistance provided to comanagers and others in 2002 included collection of captive broodstock parr from Catherine Creek and the upper Grande Ronde River, maturity sorts and spawning activities at Bonneville Hatchery, spawning ground surveys in the Grande Ronde, Imnaha, and Wenaha basins, and review of a Sea Grant proposal.

INTRODUCTION

Spring chinook salmon populations in Catherine Creek and the upper Grande Ronde River, along with other streams in the Snake River basin, have experienced severe declines in abundance over the past two decades. In order to prevent extinction in the short term, and rebuild populations over the long term, a supplementation program for spring chinook salmon in Catherine Creek and the upper Grande Ronde River was initiated. This program has incorporated the use of both captive and conventional broodstocks. The captive broodstock component of the program uses wild parr collected by seining that are reared to maturity at facilities near Seattle, Washington (Manchester Marine Laboratory) and Hood River, Oregon (Bonneville Hatchery). These fish are spawned and their progeny reared in hatcheries, and acclimated and released into streams of parental origin. The conventional broodstock component uses unmarked fish collected at traps near the spawning areas, transported to Lookingglass Hatchery near Elgin, Oregon, and held until ripe. These fish are spawned, and their progeny are also reared in a hatchery environment, acclimated, and released into streams of parental origin. All progeny released receive one or more marks including a fin (adipose) clip, coded wire tag, PIT tag, or visual implant elastomer tag.

Supplementation has many definitions (Bugert 1998). The supplementation program for Catherine Creek and upper Grande Ronde River spring chinook salmon conforms to the definition by RASP (1992):

> *Supplementation is the use of artificial propagation in an attempt to maintain or increase natural production while maintaining the long-term fitness of the target population and keeping the ecological and genetic impacts on nontarget populations within specified limits* (RASP 1992).

Bugert (1998) described the functional underpinnings of this definition (e.g., trapping broodstock close to where they spawn). Monitoring and evaluation of supplementation methods and results are necessary to determine program effectiveness, including the “no footprint” (Bugert 1998) requirement of the definition.

Activities for this project focus on two life stages of spring chinook salmon: juveniles during the migration from freshwater to the ocean and adults during prespawning migration through the end of spawning. Life history, production, and genetics are monitored and evaluated to determine program effectiveness.

Native steelhead populations in the Snake River basin have declined along with other anadromous species. Harvest augmentation of summer steelhead in the Grande Ronde River basin has been used by managers to provide a sport fishery in Catherine Creek, the upper Grande Ronde River, and other streams in the basin. Results indicate that from an angler perspective, this program has been very successful. However, the hatchery stock used (Wallowa), for reasons poorly understood, has a high rate of straying into the Deschutes River. For this and other reasons, NOAA (National Oceanic and Atmospheric Administration) Fisheries has directed that the use of Wallowa stock by phased out by 2008. A new biological opinion regarding steelhead is due out in 2003. Baseline life history information for Grande Ronde River basin summer steelhead is lacking and has delayed the articulation of management alternatives. The existence of adult collection weirs on Catherine Creek, the upper Grande Ronde River, and other streams in the basin provide opportunities to collect valuable adult life history information during the spawning migration that occurs during February-July.

Detailed descriptions of the terrestrial and aquatic habitats of the upper Grande Ronde River and Catherine Creek can be found in documents produced by the Oregon Department of Environmental Quality (ODEQ 1995, ODEQ 1998, ODEQ 2002). Duncan (1998) described the synthesis of law and science in efforts to restore ecosystem integrity to the Grande Ronde basin. Efforts to manage the Blue Mountains, of which the Grande Ronde River is a critical element, were critiqued by Langston (1996).

METHODS

Juvenile Spring Chinook Migration Timing, Minimal Cumulative Unique Detection Rates, and Juvenile Production

Approximately 20,000 juvenile spring chinook salmon were released from the Catherine Creek acclimation facility in 2002. The number of PIT-tagged fish released is to estimate migration timing and survival during the juvenile stage and smolt-to-adult survival. A much smaller number (500-2,000) of PIT-tagged juveniles is released from the upper Grande Ronde River acclimation facility each year, and used to describe juvenile migration timing and survival to the ocean. PIT tag detection data from the PTAGIS database (http://www.ptagis.org) were obtained and used to describe migration timing and minimum survival rates for acclimated and wild fish. Migration timing was described using the date of detection at Lower Granite Dam. Detections for each date at Lower Granite were expanded by the amount of spill, since fish going over the dam in spill would not be detected. The expansion factor was calculated as the sum of powerhouse and spillway flows divided by the powerhouse flow. Minimum cumulative unique detections at all PIT tag observation sites along the Snake River-Columbia River migration corridor was used to estimate minimum survival to Lower Granite Dam. Wild spring chinook juveniles in both Catherine Creek and the upper Grande Ronde River were collected by the Oregon Department of Fish and Wildlife using screw traps (Jonasson et al. 2002).

Adult Spring Chinook Salmon and Summer Steelhead Life Histories

Characterization of adult spring chinook salmon life history includes migration timing, abundance, age, length and sex frequencies, length-at-age, hatchery/wild ratios, fecundity, genetic diversity, spawn timing and spawning ground distribution, and fractions of spawned-out females observed on the spawning grounds. Production will be described using smolt to adult ratios and survival from adult to adult.

Characterization of adult summer steelhead life history will include migration timing, age, abundance, length and sex frequencies, length-at-age, hatchery/wild ratios.

Population estimates were made for summer steelhead spawning above the weir by marking all fish collected with an opercle punch and observing fallbacks on the weir as recaptures. The Chapman modification of the Petersen method of population estimation was used (Ricker 1975). An important element of summer steelhead life history will be describing any genetic differences between Catherine Creek and upper Grande Ronde River populations and others in the Grande Ronde River basin.

Much of the information for this project will be collected at adult collection weirs and spawning ground surveys conducted in addition to those regularly scheduled (Parker et al. 1995). McLean et al. (2002) described weir operations and methods to collect data for summer steelhead and spring chinook salmon captured at the upper Grand Ronde River and Catherine Creek adult traps.

Scales from spring chinook salmon and summer steelhead were aged using standard methods (references). Age 3 spring chinook spent one year in the ocean, age 4 spring chinook two years, and age 5 spring chinook, three years. Summer steelhead were aged using the f/w designation, where f=years in freshwater and w=years in saltwater. For example, 2/1 would be a "1-salt" fish (2 years rearing in freshwater and 1 year spent in saltwater).

Descriptive statistics were used to summarize data for the different species, life stages and sampling methods. Differences in distributions of arrival date at Lower Granite Dam were evaluated between groups using Kolmogorov-Smirnov tests (two-tailed) were used to evaluate differences in migration timing between groups (Sokal and Rolhf 1995). Two-sample t-tests were used to evaluate differences in mean fork length between groups (Sokal and Rolhf 1995). A significance level of P=0.05 was used for all tests. Statistix 7 (Analytical Software 2000) was used to conduct statistical tests.

PART I: MONITORING AND EVALUATION OF ENDEMIC SPRING CHINOOK SALMON SUPPLEMENTATION IN CATHERINE CREEK AND THE UPPER GRANDE RONDE RIVER, OREGON

Results

Juvenile Spring Chinook Salmon Life Histories

Volitional releases from the upper Grande Ronde River acclimation facility varied considerably day-to-day, but at the Catherine Creek facility, were concentrated during the first week (Figure 1). The total estimated numbers of PIT-tagged fish that left volitionally from the upper Grande Ronde River and Catherine Creek acclimation facilities were 45.5% and 38.4%, respectively, of the total numbers originally received. Volitional releases from both facilities showed major peaks two days before forceout. Mean fork lengths at PIT-tagging of volitionally-released fish were 1.1-1.7 mm greater than for forceout fish for both Catherine Creek and the upper Grande Ronde River (Table 1). Mean fork lengths at tagging were significantly different between release types for both streams. Median arrival dates at Lower Granite Dam were 1-4 days earlier for volitionally-released fish from both streams; there was a significant difference in the arrival date distribution for Catherine Creek but no the upper Grande Ronde River (Table 2). Minimal cumulative unique detection rates were similar for both release types in both streams (Table 3).

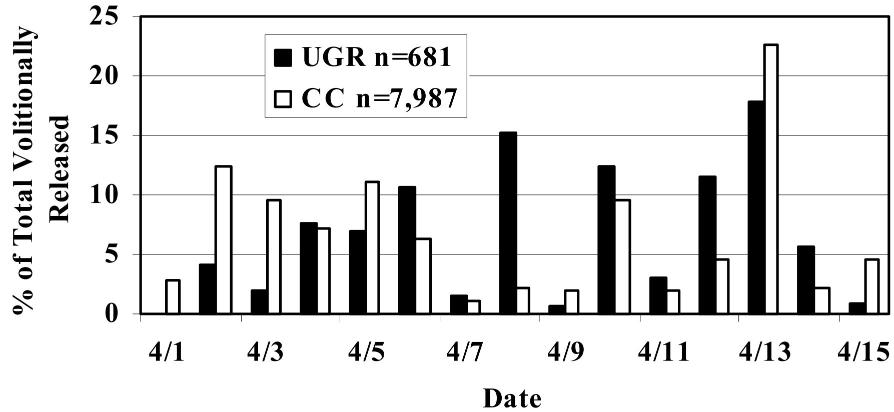


Figure 1. Frequency distribution by date of volitionally-released spring chinook salmon acclimated at Catherine Creek (CC) and upper Grande Ronde River (UGR) facilities, 2002.

Table 1. Mean fork length at PIT-tagging of migration year 2002 hatchery-origin spring chinook salmon from Catherine Creek and the upper Grande Ronde River by release type, 2002.

Stream	Group	n	Mean	SD	Range	t-test P value
Catherine Creek	Volitional	7,977	116.2	9.9	86-182	<0.0001
	Forceout	4,895	114.5	7.8	78-163	
upper Grande	Volitional	678	112.6	9.2	73-165	0.0235
Ronde River	Forceout	499	111.5	8.1	90-167	

Table 2. Arrival dates at Lower Granite Dam of PIT-tagged migration year 2002 hatchery-origin spring chinook salmon from Catherine Creek and the upper Grande Ronde River by release type, 2002.

Stream	Group	N*	Median	Earliest	Latest	K-S P value
Catherine Creek	Volitional	1,237	5/15	4/15	7/31	<0.0001
	Forceout	771	5/19	5/3	6/24	

upper Grande	Volitional	105	5/17	4/30	5/31	0.2212
Ronde River	Forceout	70	5/18	4/27	5/25	

* Expanded for spill

Mean fork length at tagging of acclimated fish was considerably larger than wild fish for both Catherine Creek and the upper Grande Ronde River (Table 4). Prerelease sampling conducted on February 9-13, 2002, showed mean fork lengths of 122.7 mm for Catherine Creek fish and 135.8 for upper Grande Ronde River fish (ODFW, unpublished data).

Table 3. Minimum cumulative unique PIT-tag detections of migration year 2002 spring chinook salmon from Catherine Creek and the upper Grande Ronde River by release type and detection site, 2002.

	Catherine Creek				**upper Grande Ronde River**			
Detection Site	**Vol**	**%**	**Force**	**%**	**Vol**	**%**	**Force**	**%**
Lower Granite	910	33.5	574	35.5	71	30.6	46	26.7
Little Goose	675	24.9	453	28.0	64	27.6	61	35.5
Lower Monumental	673	24.8	382	23.6	56	24.1	41	23.8
McNary	267	9.8	111	6.9	26	11.2	13	7.6
John Day	72	2.7	36	2.2	6	2.6	4	2.3
Bonneville	87	3.2	40	2.5	7	3.0	4	2.3
Columbia R. Islands[1]	7	0.3	4	0.2	1	0.4	0	0
Columbia R. Estuary	23	0.8	16	1.0	1	0.4	3	1.7
Recovered from All Sites[2]	2,714	34.0	1,616	33.0	232	34.1	172	34.5
Number released	7,987		4,899		681		499	

Vol = volitionally-released

Force = force out at end of acclimation period
% = percent of total releases for each group
[1] Tags recovered from fish eaten by avian predators (Collis et al. 2002).

Migration timing was later for wild fish from Catherine Creek than hatchery fish (Table 5). Wild fish arrived at Lower Granite roughly equally distributed (by week) from the week of April 23 to the week of June 11. Hatchery fish had a clear peak in arrival timing the week of May 14, with most fish arriving the weeks of April 30-May 21 (Figure 2). A similar pattern existed for upper Grande Ronde fish (Figure 3).

The minimum detection rate through the hydropower system for hatchery-origin fish was double that for wild fish from Catherine Creek (Table 6). The minimum detection rate for hatchery-origin fish was the same as wild fish for the upper Grande Ronde River.

Table 4. Mean fork length at PIT-tagging of migration year 2002 wild and hatchery-origin spring chinook salmon from Catherine Creek and the upper Grande Ronde River, 2002.

Stream	Group	n	Mean	SD	Range
Catherine Creek	Hatchery	20,796	115.2	9.3	74-186
	Wild	1,677	78.3	9.8	58-139
upper Grande	Hatchery	1,491	112.0	8.5	73-167
Ronde	Hatchery*	500	112.7	9.3	83-166
River	Wild	881	82.2	7.9	62-119

* Fall = hatchery-origin fish (captive broodstock progeny) tagged at Lookingglass Hatchery and outplanted in the upper Grande Ronde River between the adult collection site and juvenile acclimation site in October 2001

Table 5. Arrival dates at Lower Granite Dam of migration year 2002 wild and hatchery-origin spring chinook salmon from Catherine Creek and the upper Grande Ronde River, 2002.

Stream	Group	N[a]	Median	Earliest	Latest	K-S P value
Catherine Creek	Hatchery	3,061	5/17	4/11	7/31	<0.0001
	Wild	130	5/17	4/15	7/1	
upper Grande	Hatchery	213	5/18	4/22	5/31	<0.0001
Ronde	Hatchery*	41	5/12	5/3	5/21	
River	Wild	147	5/29	4/14	6/28	

[a] Expanded for spill

* Fall = hatchery-origin fish (captive broodstock progeny) tagged at Lookingglass Hatchery and outplanted in the upper Grande Ronde River between the adult collection site and juvenile acclimation site in October 2001

In addition to the brood year 2000 fish released from the upper Grande Ronde River acclimation facility in 2002, 32,803 brood year 2001 spring chinook captive brood progeny weighing 241.2 kg (136.0 fish/kg) were liberated into Sheep Creek (tributary to the upper Grande Ronde River entering between the acclimation and adult collection sites) on May 29, 2002. Seventy of these fish were sampled on October 17, 2002, by seining at several locations. Mean FL was 88.4 mm (SD = 4.7, minimum FL = 79 mm,

maximum FL = 101). The distributions of arrival dates to Lower Granite Dam were significantly different when comparing these fall 2001 stocked fish to both spring acclimated and released fish (two-tailed Kolmogorov statistic=0.27, P value=0.0159) and wild fish
(two-tailed Kolmogorov statistic=0.65, P value<0.0001).

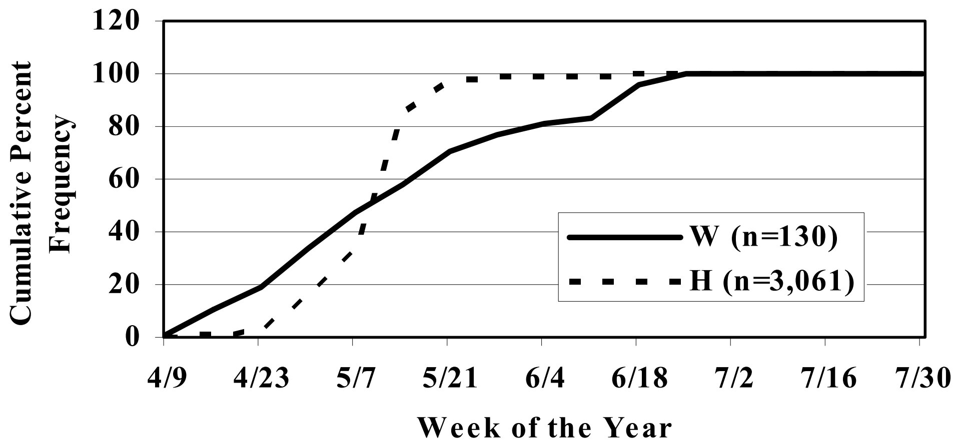
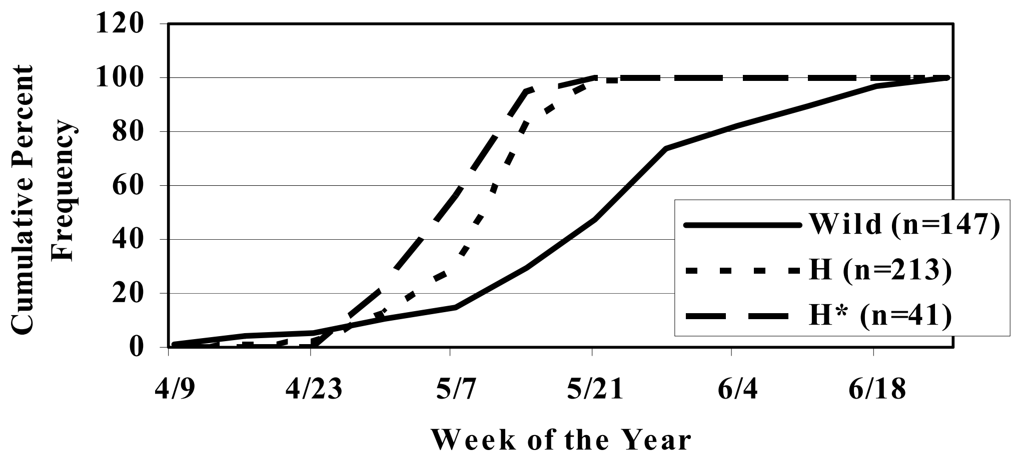


Figure 2. Cumulative percent frequency of arrival dates at Lower Granite Dam for Catherine Creek wild (W) and hatchery-origin (H) spring chinook salmon by week of the year, 2002.



* Hatchery fish stocked in fall 2001

Figure 3. Cumulative percent frequency of arrival dates at Lower Granite Dam for upper Grande Ronde River wild (W) and hatchery-origin (H) spring chinook salmon by week of the year, 2002.

Table 6. Minimum cumulative unique PIT-tag detections of migration year 2002 spring chinook salmon from Catherine Creek and the upper Grande Ronde River by detection site, 2002.

	Catherine Creek				upper Grande Ronde River					
Detection Site	**H**	**%**	**W**	**%**	**H**	**%**	**Fall**	**%**	**W**	**%**
Lower Granite	2,302	33.9	79	29.9	149	29.0	24	23.1	91	33.8
Little Goose	1,825	26.9	90	34.1	165	32.1	42	40.4	99	36.8
Lower Monumental	1,648	24.3	55	20.8	121	23.5	24	23.1	50	18.6
McNary	571	8.4	26	9.8	46	8.9	9	8.7	15	5.6
John Day	167	2.5	6	2.3	12	2.3	2	1.9	7	2.6
Bonneville	198	2.9	5	1.9	14	2.7	3	2.9	5	1.9
Columbia R. Islands[1]	17	0.3	0	0	6	1.2	0	0.00	2	0.7
Columbia R. Estuary	55	0.8	3	1.1	1	0.002	0	0.00	0	0.0
Recovered from All Sites[2]	6,783	32.6	264	15.7	514	34.4	104	20.8	269	30.5
Number released	20,796		1,684		1,496		500		881	

H = hatchery-origin fish (captive broodstock progeny) tagged at Lookingglass Hatchery in October 2001
W = wild-origin fish captured in screw traps or by seining, tagged and released on-site
Fall = hatchery-origin fish (captive broodstock progeny) tagged at Lookingglass Hatchery and outplanted in the upper Grande Ronde River between the adult collection site and juvenile acclimation site in October 2001
% = percent of total releases for each group
[1] Tags recovered from fish eaten by avian predators (Collis et al. 2002).

Adult Spring Chinook Salmon Life Histories

Adult traps began operations on March 12, 2002 (Catherine Creek) and April 22, 2002 (upper Grande Ronde River). The Catherine Creek weir experienced problems with high flows and debris accumulation during the first two weeks in May. The Catherine Creek trap ceased operations on August 13, 2002 and the upper Grande Ronde River trap on July 24, 2002. A total of 273 unmarked and 144 marked spring chinook salmon were collected (first time captures only) at the upper Grande Ronde River and Catherine Creek weirs. The majority of fish were collected between May 28 and June 25 (Figure 4). Migration timing of unmarked and ad-clipped Catherine Creek fish was similar. Only three ad-clipped fish were collected at the upper Grande Ronde River weir.

One PIT-tagged fish was collected at each trap that had been tagged at Lookingglass Hatchery and released from acclimation facilities. Both returned to the stream of parental origin. Two ad-clipped fish collected at the Catherine Creek weir had been PIT-tagged and released during the juvenile migration near the mouth of the Grande Ronde River. One ad-clipped fish was PIT-tagged and released during the juvenile migration on the Snake River. One unmarked fish collected at the upper Grande Ronde River weir was PIT-tagged and released as a juvenile at the screw trap about 5 km downstream operated by ODFW. One unmarked fish collected at the upper Grande Ronde River weir was PIT-tagged and released in the John Day River.

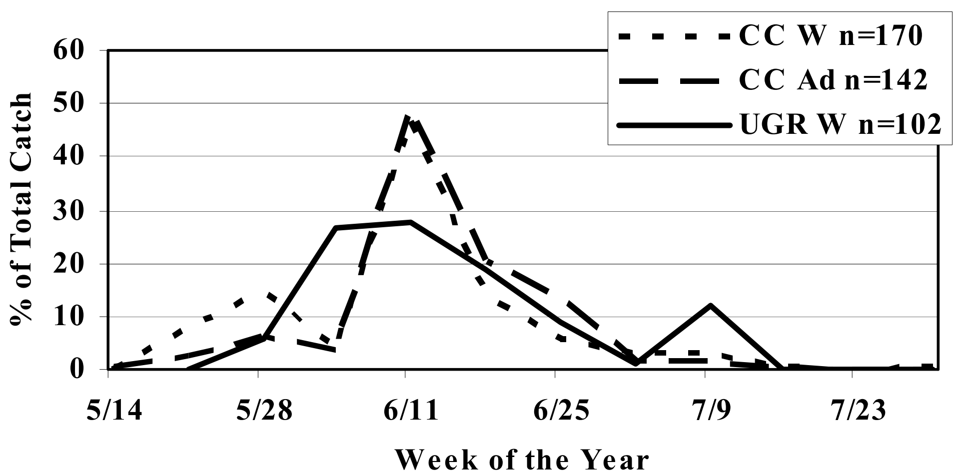


Figure 4. Percentages of wild (W) and hatchery-origin (Ad) spring chinook salmon caught by week of the year at the Catherine Creek (CC) and upper Grande Ronde River (UGR) weirs, 2002.

Age distributions of unmarked spring chinook salmon collected at the Catherine Creek and upper Grande Ronde River weirs were similar, and dominated by age 4 fish (Figure 5).

The mean length of unmarked upper Grande Ronde River fish was slightly greater than for Catherine Creek (Table 7). The three ad-clipped fish captured at the upper Grande Ronde River weir were probably age 4, and slightly larger than ad-clipped Catherine Creek fish that included both ages 3 and 4 (Table 8). Length frequencies of unmarked fish captured at the Catherine Creek and upper Grande Ronde River weirs were similar (Figure 6). Unmarked fish captured at Catherine Creek were larger than ad-clipped fish (Figure 7). Ad-clipped fish were made up of two age classes (3, 4) while unmarked fish were ages 3, 4 and 5.

Carcass recoveries during regularly scheduled spawning ground surveys totaled 115 on Catherine Creek and 8 on the upper Grande Ronde River (ODFW, unpublished data). Sixty-three percent of carcasses recovered from Catherine Creek had identifiable ad clips. Of the ad-clipped carcasses, 69% were females. One unmarked female were recorded as 20% spawned out, the remainder ranged from 99-100%. Four ad-clipped females were recorded as 25-80% spawned out. Four stream sections that provided 61% of the ad-clipped carcasses provided 92% of the unmarked carcasses. Eight additional surveys from July 23-September 18 on sections of Catherine Creek, the upper Grande Ronde River, and Sheep Creek yielded an additional 19 new carcasses. A survey of one section of Catherine Creek on September 5, 2002, yielded 6 fresh carcasses that had not been sampled the previous day on the regularly scheduled spawning ground survey. Two surveys of Sheep Creek (tributary of the upper Grande Ronde River on July 26 and September 18, 2002, failed to yield any observations of spring chinook or their redds.

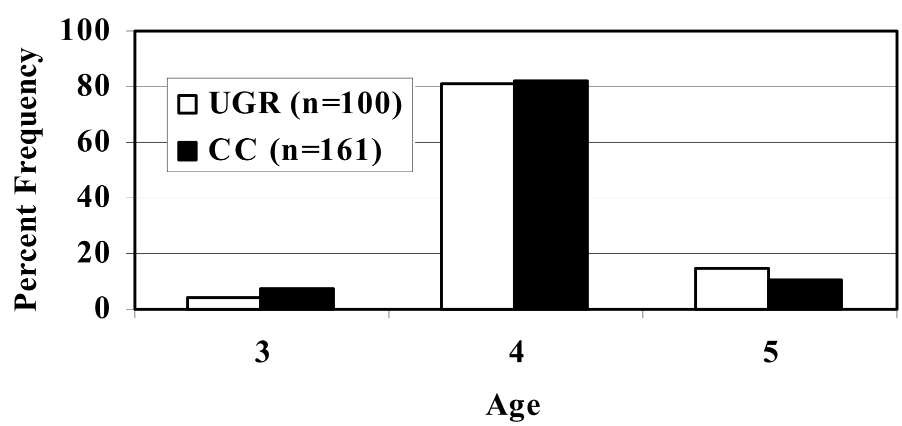


Figure 5. Age frequencies of unmarked spring chinook salmon caught at the Catherine Creek (CC) and upper Grande Ronde River (UGR) weirs, 2002.

Table 7. Length summary for unmarked Catherine Creek and upper Grande Ronde River adult spring chinook salmon, 2002.

Stream	n	Mean FL (mm)	SD	Range
Catherine Creek	170	734.1	86.4	408-944
upper Grande Ronde River	102	751.0	75.9	503-907

Table 8. Length summary for marked Catherine Creek and upper Grande Ronde River spring chinook salmon, 2002.

Stream	n	Mean FL (mm)	SD	Range
Catherine Creek	142	691.4	72.3	424-870
upper Grande Ronde River	3	718.0	26.2	696-747

Fish transported to Lookingglass Hatchery for spawning totaled 38 for Catherine Creek and 49 for the upper Grande Ronde River. Fecundity of fish spawned at Lookingglass Hatchery was similar for both Catherine Creek and the upper Grande Ronde River (Table 9). Females spawned ranged from 5.6-19.3 kg (mean 10.8) for Catherine Creek and 6.3-16.5 kg (mean 9.8) for the upper Grande Ronde River.

Age 4 fish dominated the catch of unmarked spring chinook salmon from both Catherine Creek and the upper Grande Ronde River (Tables 10 and 11).

Data on stream flows for both the North Fork of Catherine Creek and the upper Grande Ronde River upstream of the acclimation facility for water year 2002 were not received by the time this report was submitted.

Table 9. Fecundity of Catherine Creek and upper Grande Ronde River spring chinook salmon spawned in 2002.

Stream	n	Mean	SD	Range
Catherine Creek	19	4,269	1,106	1,751-6,074
upper Grande Ronde River	25	3,955	808	2,558-5,549

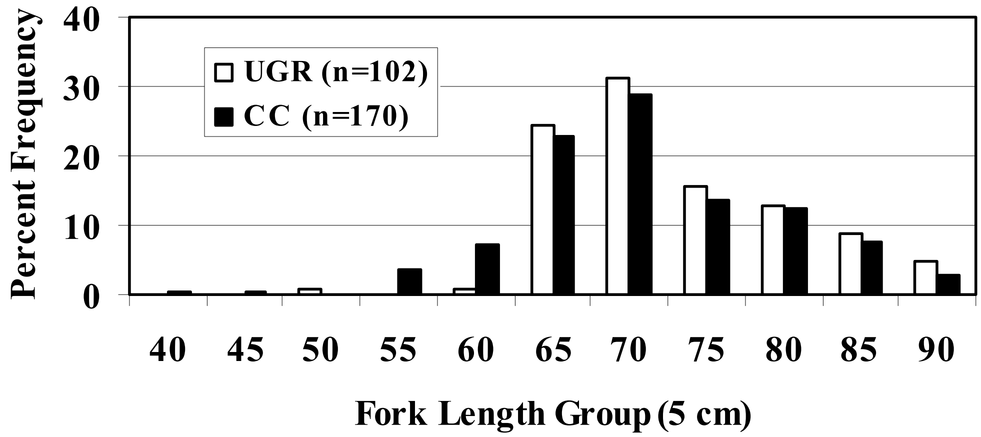


Figure 6. Length frequencies of unmarked spring chinook salmon caught at the Catherine Creek (CC) and upper Grande Ronde River (UGR) weirs, 2002.

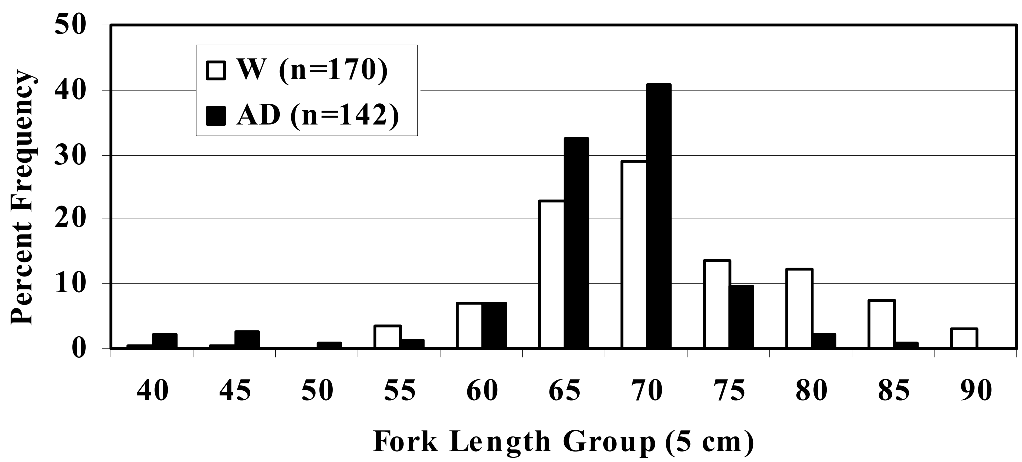


Figure 7. Length frequencies of hatchery-origin (AD) and unmarked (W) spring chinook salmon caught at the Catherine Creek weir, 2002.

Table 10. Age-length distribution for unmarked spring chinook salmon collected at the Catherine Creek weir, 2002.

	% Age Distribution			
FL (cm)	3	4	5	No. aged
40-44	100.0			1
45-49	100.0			1
50-54	0			
55-59	66.7	33.3		6
60-64	36.4	63.6		12
65-69	5.4	94.6		39
70-74		100.0		49
75-79		100.0		23
80-84		76.2	23.8	21
85-89		41.7	58.3	15
90-94			100.0	5
Mean FL	586.8	729.6	876.8	
SD	79.7	62.2	40.5	
Min	408	569	800	
Max	692	891	944	
n	12	132	17	

Table 11. Age-length distribution for unmarked spring chinook salmon collected at the upper Grande Ronde River weir, 2002.

	% Age Distribution			
FL (cm)	3	4	5	No. aged
50-54	100.0			1
55-59				0
60-64	100.0			1
65-69	8.0	92.0		25
70-74		100.0		32
75-79		100.0		16
80-84		76.9	23.1	13
85-89		11.1	88.9	9
90-94			100.0	5
Mean FL	626.5	732.6	878.1	
SD	84.5	49.3	23.2	
Min	503	651	837	
Max	694	863	907	
n	4	81	15	

Discussion

Data from the first three years of monitoring migration timing, statistically significant differences have been found in mean fork length between volitionally-released and forced-out spring chinook juveniles, as well as differences in the distributions of arrival dates to Lower Granite Dam. Differences have been found between hatchery-origin and wild groups for these measures. In 2002, median arrival dates for hatchery and wild fish were similar, but distributions were different. Hatchery fish tended to arrive concentrated near the median date, but arrival dates of wild fish were more spread out. Differences may be significant statistically, it is not clear whether or how they affect long-term fitness of the populations. More years of juvenile data are needed for any meaningful comparisons, as well as adult returns.

The most striking differences between hatchery-origin and wild juveniles are size at release (after acclimation for hatchery fish and after PIT-tagging for wild fish) and minimum survival to Lower Granite Dam. Mean size of hatchery-origin juveniles is much greater. Comanagers decided to use a larger size at release in order to have improved survival through the migration corridor and more returns as adults. Another factor conferring better growth on hatchery-reared juveniles is the higher rearing temperatures in the hatchery. The larger size of hatchery-origin fish has produced the intended result of improved survival.

The larger size of hatchery-reared fish probably has limited short-term effect on wild conspecifics, since they rapidly leave headwaters areas and enter the Snake and Columbia Rivers and then the ocean. Over the longer term, the larger size of hatchery fish may affect the number of precocious males that contribute to the spawning population (Busack et al. 1997). Directed sampling effort (snorkeling) may be useful to determine the numbers of hatchery-origin precocious males compared to wild fish.

The numbers of spring chinook adults captured at both weirs was substantially higher in 2002 than previous years, primarily due to having better functioning weirs. The Catherine Creek weir was approximately 61% efficient (weir efficiency = total number caught and passed at weir/population estimate above the weir*100). The Catherine Creek weir was down for a period during a period of high flow and apparently substantial numbers of fish were able to pass upstream without being trapped. This restricts the take of broodstock to those times when the weir is functional, preventing sampling across the run. The upper Grande Ronde River weir was about 89% efficient. The weirs began operation early enough, but in years of late runs (e.g., 2000) ending the take of broodstock early may have negative effects.

The size and age composition of spring chinook adults collected at both weirs during the first two years of hatchery-origin adult returns were consistent with previously collected data. Four year old hatchery-origin fish returned in substantial numbers to Catherine Creek in 2002. The majority of carcasses recovered on the Catherine Creek spawning grounds were hatchery-origin and appeared to spawn in the same areas as wild fish (ODFW, unpublished data). There were several hatchery-origin females that did not appear to be completely spawned out. The large number of unsampled fresh carcasses recovered one day after the regular survey suggests that more frequent surveys (more than once a week for 3 weeks) will provide substantially more life history information for adults. Fecundity (eggs per female) of fish spawned from both streams in 2002 was slightly higher than reported for several Snake River tributaries (Myers et al. 1998).

Juvenile production and calculation of smolt-to-adult ratios (SAR) will be delayed until more years of data are collected. After the 2004 spawning season, a SAR can be estimated for the brood year 1998 captive brood progeny released in 2000. The 1998 brood year has returned to date (as age 3 and age 4 fish) a minimum of 0.4% of the number of juveniles acclimated and released.

In addition to the life history characteristics described, genetic monitoring is a critical component of the evaluation program. Tissues have been taken from all adult spring chinook salmon collected at the weirs as well as carcasses encountered on spawning ground surveys that do not have an opercle punch. These tissues are archived and await a formal contract to conduct laboratory tests and statistical analysis.

PART II. LIFE HISTORY OF SUMMER STEELHEAD IN CATHERINE CREEK AND THE UPPER GRANDE RONDE RIVER, OREGON

Results

Most upstream migrating summer steelhead in the upper Grande Ronde River were caught in April and May, with the highest catches right after the trap began operations (Figure 8). Population estimates of fish migrating above the weirs to spawn were 398 for Catherine Creek (95% confidence intervals 253-543), and 137 for the upper Grande Ronde River (95% confidence intervals 78-196). Mean FL of males and females were similar (Table 12). All fish were unmarked (wild) except for one female with a left ventral clip. Length frequencies suggested that most fish were 1-ocean, and fallbacks were larger than upstream migrating fish (Figure 9). Thirty-seven fallbacks (kelts) were collected from April 29-June 21, including 7 fish previously marked and passed.

Summer steelhead catches from Catherine Creek showed two peaks, the first week in April and a second, smaller one the second week in May (Figure 10). Mean FL of males was about 19 mm greater than for females (Table 13). All fish were unmarked (wild) except for one female with an adipose clip. The modal length groups were 60-61 cm (Figure 11). Using the age-length key in Table 14 to expand the total catch of 259, 76.7% of the total caught were 1-ocean fish and the remainder 2-ocean. Thirteen fallbacks (kelts) were collected from April 9-July 24, including 8 fish previously marked and passed.

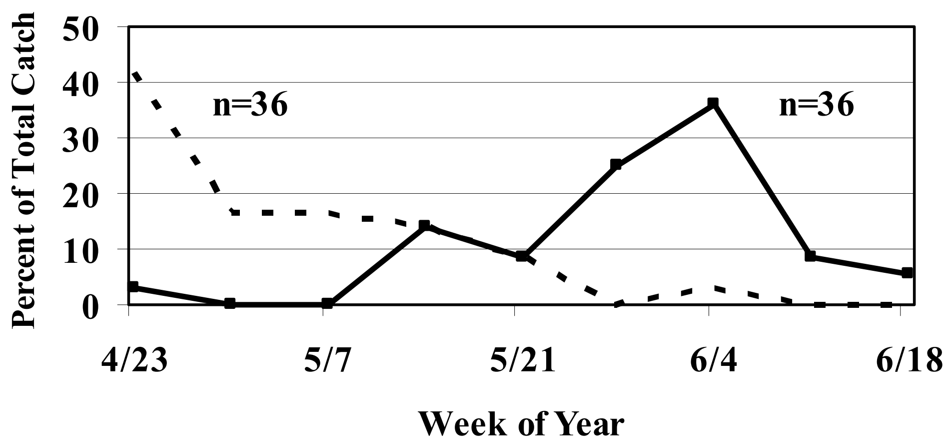


Figure 8. Percentages of unmarked, upstream-migrating (dashed line) and fallback (solid line) summer steelhead caught by week of the year at the upper Grande Ronde River weir, 2002. (includes recaptures)

Table 12. Summary statistics for unmarked summer steelhead captured at the upper Grande Ronde River weir, 2002.

Sex	Mean FL (mm)	SD	Range	n
Male	638.3	52.7	549-757	25
Female	632.7	57.1	555-770	38
Combined*	634.9	55.0	549-770	63

* first-time captures only; includes fallbacks

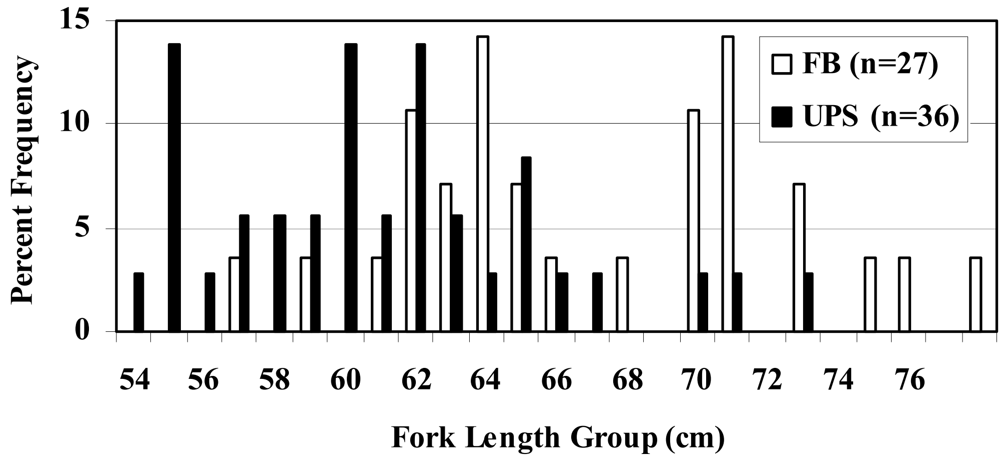


Figure 9. Length frequency of unmarked, upstream-migrating (UPS) and fallback (FB) summer steelhead captured at the upper Grande Ronde River weir, 2002 (first time captures only).

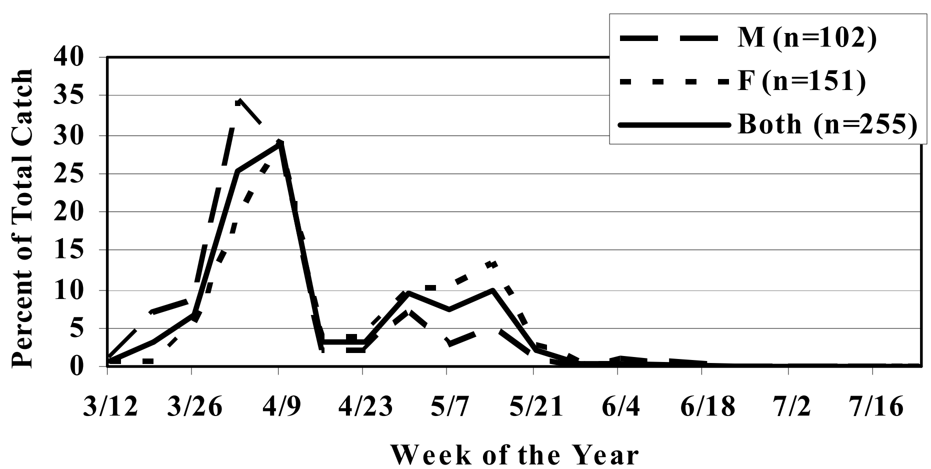


Figure 10. Percentages of unmarked, upstream-migrating male (M), female (F), and sexes combined (Both) summer steelhead caught by week of the year at the Catherine Creek weir, 2002.

Table 13. Summary statistics for unmarked summer steelhead collected at the Catherine Creek weir, 2002.

Sex	Mean FL (mm)	SD	Range	n
Male	642.7	61.0	534-838	106
Female	619.5	50.0	490-752	151
Unknown	577.5	43.1	547-608	2
Combined*	628.7	55.9	490-838	259

* first-time captures only; includes fallbacks

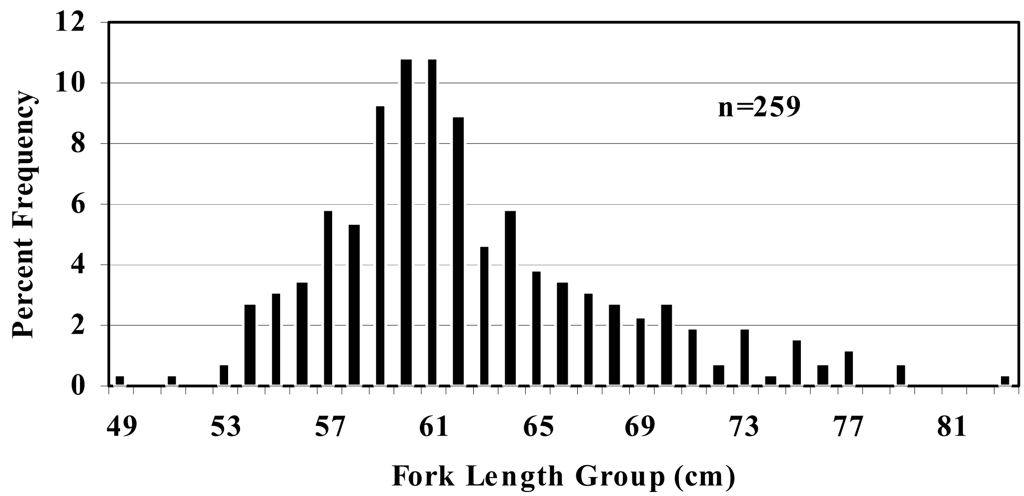


Figure 11. Length frequency of unmarked summer steelhead caught at Catherine Creek weir, 2002.

Table 14. Age-length distribution for unmarked summer steelhead collected at the Catherine Creek weir, 2002.

	% Age Distribution		
FL (cm)	2/1	2/2	No. aged
50-54	100.0	0	10
55-59	95.2	4.8	62
60-64	94.6	5.4	92
65-69	37.1	62.9	35
70-74	29.4	70.6	17
75-79	0	100.0	8
80-84	0	100.0	1
Mean FL	607.4	695.5	
SD	35.6	55.8	
Min	517	550	
Max	712	838	
n	174	51	

Discussion

From limited data, including angler reports, it appears that steelhead migrate upstream past the weir location in Catherine Creek beginning in March, and the upper Grande Ronde River weir in April. There appears to be only a small amount of steelhead spawning habitat below the Catherine Creek weir, so early operation of an effective weir should capture most of the spawning run. A surprising number of summer steelhead was collected at the upper Grande Ronde River weir in 2002. It has been thought that a substantial number of summer steelhead migrating up the upper Grande Ronde River divert to other streams (e.g. Meadow Creek, Five Points Creek) to spawn before reaching the weir. The high number of fallbacks indicates that trap operation should begin earlier in order to sample across the run.

Population estimates suggested that substantial numbers of fish made it past the weirs without being handled. At the upper Grande Ronde River weir, this was most likely due to the late installation. At the Catherine Creek weir, some fish also may have passed before the weir began operating. Passage during high flows when the weir panels were down was probably more significant. Both stocks were dominated by 1-salt fish, and all fish aged spent two years in freshwater. Additional scales will be mounted and read in 2003 to describe age frequencies and life histories for both Catherine Creek and the upper Grande Ronde River. The numbers of ad-clipped steelhead (Wallowa or some other hatchery stock) trapped have decreased substantially as release of non-endemic fish is phased out (NMFS 1999).

The population estimates for summer steelhead should be viewed cautiously. For Catherine Creek, mean size of fallbacks seemed to be larger than for fish marked and passed at the weir. One or more of the assumptions of the population estimator used were probably violated (Ricker 1975). More years of data and a closer examination of the characteristics of fish marked and passed and those recaptured may give us confidence in these estimates.

PART III. ASSISTANCE PROVIDED TO PROGRAM COOPERATORS

Program staff assisted ODFW in conducting spawning ground surveys on Catherine Creek, the upper Grande Ronde River, tributaries of the Grande Ronde River, the Imnaha River, Wenaha River and John Day River during 2002. Project staff also assisted ODFW in spawning of Imnaha River spring chinook salmon, collecting captive brood parr from project streams and spawning of captive broodstock chinook salmon at Bonneville Fish Hatchery.

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Brian Jonasson and Pat Keniry (ODFW) provided unpublished early life history and spawning ground survey data. Craig Contor (CTUIR) and Tim Hoffnagle

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Appendix Table 1. Data for summer steelhead collected at the Catherine Creek weir in 2002.

Date	FL	Sex	Mark	MigStat	Disp
3/14/2002	609	F	UN	UPS	P
3/17/2002	583	M	UN	UPS	P
3/21/2002	577	F	UN	UPS	P
3/22/2002	641	M	UN	UPS	P
3/24/2002	611	M	UN	UPS	P
3/24/2002	681	M	UN	UPS	P
3/24/2002	605	M	UN	UPS	P
3/24/2002	655	M	UN	UPS	P
3/25/2002	550	M	UN	UPS	P
3/25/2002	575	M	UN	UPS	P
3/26/2002	614	F	UN	UPS	P
3/26/2002	690	F	UN	UPS	P
3/27/2002	672	M	UN	UPS	P
3/27/2002	635	F	UN	UPS	P
3/27/2002	644	M	UN	UPS	P
3/27/2002	715	M	UN	UPS	P
3/27/2002	562	M	UN	UPS	P
3/27/2002	615	F	UN	UPS	P
3/27/2002	614	M	UN	UPS	P
3/29/2002	613	M	UN	UPS	P
3/29/2002	628	M	UN	UPS	P
3/29/2002	625	F	UN	UPS	P
3/31/2002	685	F	UN	UPS	P
3/31/2002	695	F	UN	UPS	P
3/31/2002	641	M	UN	UPS	P
4/1/2002	678	F	UN	UPS	P
4/1/2002	652	M	UN	UPS	P
4/2/2002	701	M	UN	UPS	P
4/2/2002	678	M	UN	UPS	P
4/2/2002	682	F	UN	UPS	P
4/2/2002	773	M	UN	UPS	P
4/2/2002	664	F	UN	UPS	P
4/2/2002	628	M	UN	UPS	P
4/2/2002	573	F	UN	UPS	P
4/3/2002	620	M	UN	UPS	P
4/3/2002	690	F	UN	UPS	P
4/3/2002	634	M	UN	UPS	P
4/4/2002	608	F	UN	UPS	P
4/4/2002	598	F	UN	UPS	P
4/4/2002	570	F	UN	UPS	P
4/4/2002	734	M	UN	UPS	P
4/4/2002	672	F	UN	UPS	P
4/4/2002	595	F	UN	UPS	P
4/5/2002	624	M	UN	UPS	P
4/5/2002	614	M	UN	UPS	P
4/5/2002	664	M	UN	UPS	P
4/5/2002	719	M	UN	UPS	P
4/5/2002	641	M	UN	UPS	P
4/5/2002	615	M	UN	UPS	P
4/5/2002	628	F	UN	UPS	P
4/5/2002	604	M	UN	UPS	P
4/5/2002	615	M	UN	UPS	P
4/5/2002	647	M	UN	UPS	P
4/5/2002	752	F	UN	UPS	P
4/5/2002	635	M	UN	UPS	P
4/5/2002	720	F	UN	UPS	P
4/5/2002	563	M	UN	UPS	P
4/5/2002	641	M	UN	UPS	P
4/5/2002	539	F	UN	UPS	P
4/5/2002	711	F	UN	UPS	P
4/5/2002	628	M	UN	UPS	P
4/5/2002	671	M	UN	UPS	P
4/5/2002	635	F	UN	UPS	P
4/5/2002	674	F	UN	UPS	P
4/5/2002	590	F	UN	UPS	P
4/5/2002	639	F	UN	UPS	P
4/5/2002	664	M	UN	UPS	P
4/5/2002	569	M	UN	UPS	P
4/5/2002	610	M	UN	UPS	P
4/5/2002	586	F	UN	UPS	P
4/5/2002	612	F	UN	UPS	P
4/6/2002	658	M	UN	UPS	P
4/6/2002	584	F	UN	UPS	P
4/6/2002	643	M	UN	UPS	P
4/6/2002	757	M	UN	UPS	P
4/6/2002	612	F	UN	UPS	P
4/6/2002	607	M	UN	UPS	P
4/8/2002	624	M	UN	UPS	P
4/8/2002	622	F	UN	UPS	P
4/8/2002	590	M	UN	UPS	P
4/8/2002	704	M	UN	UPS	P
4/8/2002	636	M	UN	UPS	P
4/8/2002	605	F	UN	UPS	P
4/8/2002	620	F	UN	UPS	P
4/8/2002	698	F	UN	UPS	P
4/8/2002	734	F	UN	UPS	P
4/8/2002	581	F	UN	UPS	P
4/8/2002	561	M	UN	UPS	P

F = female, M = male, U = unknown
UN = unmarked, AD = adipose clip (hatchery-origin)
UPS = upstream-migrating, FB = fallback (kelt)
P = passed, WM = weir mortality, K = removed from stream

Appendix Table 1 continued

Date	FL	Sex	Mark	MigStat	Disp
4/8/2002	584	F	UN	UPS	P
4/8/2002	632	M	UN	UPS	P
4/8/2002	595	M	UN	UPS	P
4/9/2002	658	F	UN	UPS	P
4/9/2002	575	F	UN	UPS	P
4/9/2002	649	M	UN	UPS	P
4/10/2002	730	F	UN	UPS	P
4/10/2002	579	F	UN	UPS	P
4/10/2002	517	F	UN	UPS	P
4/10/2002	578	M	UN	UPS	P
4/10/2002	765	M	UN	UPS	P
4/10/2002	610	F	UN	UPS	P
4/10/2002	660	M	UN	UPS	P
4/10/2002	612	F	UN	UPS	P
4/10/2002	568	F	UN	UPS	P
4/10/2002	597	M	UN	UPS	P
4/10/2002	652	F	UN	UPS	P
4/10/2002	614	F	UN	UPS	P
4/10/2002	559	F	UN	UPS	P
4/11/2002	599	F	UN	UPS	P
4/11/2002	570	F	UN	UPS	P
4/11/2002	795	M	UN	UPS	P
4/11/2002	591	F	UN	UPS	P
4/11/2002	625	M	UN	UPS	P
4/11/2002	654	M	UN	UPS	P
4/11/2002	534	M	UN	UPS	P
4/11/2002	703	F	UN	UPS	P
4/11/2002	550	F	UN	UPS	P
4/11/2002	599	M	UN	UPS	P
4/11/2002	618	F	UN	UPS	P
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4/11/2002	607	F	UN	UPS	P
4/11/2002	599	M	UN	UPS	P
4/11/2002	724	F	UN	UPS	P
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4/11/2002	618	M	UN	UPS	P
4/11/2002	618	F	UN	UPS	P
4/11/2002	583	F	UN	UPS	P
4/13/2002	610	F	UN	UPS	P
4/13/2002	605	F	UN	UPS	P
4/13/2002	610	F	UN	UPS	P
4/13/2002	737	M	UN	UPS	P
4/13/2002	621	M	UN	UPS	P
4/13/2002	699	F	UN	UPS	P
4/13/2002	594	M	UN	UPS	P
4/13/2002	597	F	UN	UPS	P

Date	FL	Sex	Mark	MigStat	Disp
4/13/2002	635	F	UN	UPS	P
4/13/2002	610	M	UN	UPS	P
4/13/2002	648	F	UN	UPS	P
4/13/2002	649	M	UN	UPS	P
4/13/2002	670	F	UN	UPS	P
4/13/2002	750	F	UN	UPS	P
4/13/2002	635	M	UN	UPS	P
4/13/2002	765	M	UN	UPS	P
4/13/2002	680	M	UN	UPS	P
4/13/2002	615	M	UN	UPS	P
4/13/2002	613	F	UN	UPS	P
4/14/2002	605	F	UN	UPS	P
4/14/2002	624	M	UN	UPS	P
4/14/2002	791	M	UN	UPS	P
4/14/2002	774	M	UN	UPS	P
4/14/2002	584	F	UN	UPS	P
4/14/2002	646	F	UN	UPS	P
4/14/2002	542	F	UN	UPS	P
4/14/2002	608	F	UN	UPS	P
4/14/2002	566	F	UN	UPS	P
4/14/2002	778	M	UN	UPS	P
4/14/2002	602	M	UN	UPS	P
4/14/2002	625	F	UN	UPS	P
4/15/2002	577	M	UN	UPS	P
4/15/2002	628	F	UN	UPS	P
4/15/2002	648	M	UN	UPS	P
4/15/2002	629	F	UN	UPS	P
4/15/2002	601	F	UN	UPS	P
4/15/2002	701	F	UN	UPS	P
4/15/2002	638	F	UN	UPS	P
4/17/2002	602	M	UN	UPS	P
4/17/2002	662	F	UN	UPS	P
4/17/2002	648	F	UN	UPS	P
4/17/2002	737	M	UN	UPS	P
4/17/2002	749	F	UN	UPS	P
4/17/2002	580	F	UN	UPS	P
4/17/2002	574	F	UN	UPS	P
4/17/2002	572	F	UN	UPS	P
4/27/2002	603	F	UN	UPS	P
4/27/2002	651	M	UN	UPS	P
4/27/2002	577	F	UN	UPS	P
4/29/2002	567	M	UN	UPS	P
4/29/2002	543	F	UN	UPS	P
4/29/2002	664	F	UN	UPS	P
4/29/2002	546	F	UN	UPS	P
4/29/2002	606	F	UN	UPS	P

Appendix Table 1 continued

Date	FL	Sex	Mark	MigStat	Disp
4/30/2002	604	M	UN	UPS	P
5/1/2002	754	M	UN	FB	WM
5/2/2002	838	M	UN	UPS	P
5/2/2002	597	M	UN	UPS	P
5/2/2002	654	M	UN	UPS	P
5/2/2002	686	F	UN	UPS	P
5/2/2002	608	U	UN	UPS	P
5/2/2002	654	M	UN	UPS	P
5/2/2002	626	F	UN	UPS	P
5/2/2002	559	F	UN	UPS	P
5/2/2002	645	M	UN	UPS	P
5/2/2002	584	F	UN	UPS	P
5/2/2002	547	U	UN	UPS	P
5/2/2002	603	F	UN	UPS	P
5/3/2002	585	F	UN	UPS	P
5/3/2002	607	F	UN	UPS	P
5/3/2002	559	F	UN	UPS	P
5/3/2002	558	F	UN	UPS	P
5/3/2002	587	M	UN	UPS	P
5/3/2002	631	F	UN	UPS	P
5/4/2002	540	M	AD	UPS	K
5/4/2002	557	F	UN	UPS	P
5/4/2002	546	F	UN	UPS	P
5/4/2002	675	F	UN	UPS	P
5/5/2002	669	F	UN	UPS	P
5/6/2002	597	F	UN	UPS	P
5/8/2002	705	F	UN	UPS	P
5/10/2002	601	F	UN	UPS	P
5/10/2002	557	F	UN	UPS	P
5/10/2002	597	F	UN	UPS	P
5/10/2002	572	F	UN	UPS	P
5/10/2002	609	M	UN	UPS	P
5/10/2002	617	F	UN	UPS	P
5/11/2002	618	F	UN	UPS	P
5/13/2002	682	F	UN	UPS	P
5/13/2002	587	F	UN	UPS	P
5/13/2002	600	F	UN	UPS	P
5/13/2002	628	F	UN	UPS	P
5/13/2002	631	F	UN	UPS	P
5/13/2002	598	F	UN	UPS	P
5/13/2002	625	F	UN	UPS	P
5/13/2002	599	M	UN	UPS	P
5/13/2002	605	F	UN	UPS	P
5/13/2002	601	M	UN	UPS	P
5/13/2002	599	F	UN	UPS	P

Date	FL	Sex	Mark	MigStat	Disp
5/14/2002	621	F	UN	UPS	P
5/14/2002	628	F	UN	UPS	P
5/14/2002	664	F	UN	UPS	P
5/14/2002	598	F	UN	UPS	P
5/14/2002	569	F	UN	UPS	P
5/14/2002	605	F	UN	UPS	P
5/14/2002	599	F	UN	UPS	P
5/15/2002	686	F	UN	UPS	P
5/15/2002	610	F	UN	UPS	P
5/15/2002	609	M	UN	UPS	P
5/15/2002	620	M	UN	UPS	P
5/15/2002	641	M	UN	UPS	P
5/15/2002	665	F	UN	UPS	P
5/15/2002	619	F	UN	UPS	P
5/16/2002	693	F	UN	UPS	P
5/17/2002	708	M	UN	UPS	P
5/17/2002	620	F	UN	UPS	P
5/17/2002	706	M	UN	UPS	P
5/18/2002	598	F	UN	UPS	P
5/19/2002	597	F	UN	UPS	P
5/19/2002	569	F	UN	UPS	P
5/19/2002	712	F	UN	UPS	P
5/20/2002	611	F	UN	UPS	P
5/20/2002	593	F	UN	UPS	P
5/20/2002	584	F	UN	UPS	P
5/21/2002	490	F	UN	UPS	P
5/22/2002	619	M	UN	UPS	P
5/24/2002	578	F	UN	UPS	P
5/25/2002	654	F	UN	UPS	P
5/27/2002	599	F	UN	UPS	P
5/27/2002	710	M	UN	FB	WM
5/28/2002	549	F	UN	UPS	P
6/6/2002	583	M	UN	UPS	P
6/25/2002	546	M	UN	FB	WM
7/24/2002	600	M	UN	FB	WM

Appendix Table 2. Data for spring chinook collected at the Catherine Creek weir in 2002.

Date	Sex	Marks	FL	Dispos
5/20/2002	F	AD	740	P
5/25/2002	F	UN	667	P
5/25/2002	F	UN	800	P
5/26/2002	M	AD	729	P
5/26/2002	M	UN	698	P
5/26/2002	M	UN	703	P
5/26/2002	F	UN	715	LGH
5/26/2002	F	UN	815	P
5/26/2002	F	UN	820	P
5/27/2002	M	AD	693	P
5/27/2002	M	AD	737	P
5/27/2002	M	AD	741	P
5/27/2002	F	UN	689	P
5/27/2002	F	UN	740	P
5/27/2002	M	UN	755	P
5/27/2002	F	UN	762	P
5/27/2002	M	UN	762	P
5/27/2002	F	UN	865	P
5/28/2002	F	AD	660	P
5/28/2002	F	AD	702	P
5/28/2002	F	AD	714	P
5/28/2002	F	AD	745	P
5/28/2002	M	AD	765	P
5/28/2002	F	AD	870	P
5/28/2002	F	UN	639	P
5/28/2002	F	UN	641	P
5/28/2002	F	UN	644	LGH
5/28/2002	F	UN	649	P
5/28/2002	F	UN	692	P
5/28/2002	F	UN	700	P
5/28/2002	M	UN	718	P
5/28/2002	F	UN	723	P
5/28/2002	M	UN	734	P
5/28/2002	M	UN	741	LGH
5/28/2002	F	UN	744	P
5/28/2002	F	UN	750	P
5/28/2002	M	UN	758	LGH
5/28/2002	M	UN	758	P
5/28/2002	M	UN	770	P
5/28/2002	F	UN	785	LGH
5/28/2002	M	UN	818	P
5/28/2002	F	UN	819	P
5/28/2002	F	UN	850	P
5/29/2002	F	UN	682	LGH
5/29/2002	M	UN	698	P

Date	Sex	Marks	FL	Dispos
5/30/2002	M	AD	688	P
5/30/2002	J	UN	569	P
5/30/2002	M	UN	661	P
5/30/2002	F	UN	712	P
5/31/2002	F	AD	648	P
5/31/2002	M	AD	714	P
6/3/2002	M	UN	821	LGH
6/4/2002	F	AD	690	P
6/5/2002	F	AD	705	P
6/5/2002	M	UN	718	P
6/5/2002	M	UN	795	P
6/6/2002	M	AD	701	P
6/6/2002	F	AD	712	P
6/6/2002	F	UN	708	P
6/6/2002	M	UN	709	LGH
6/6/2002	M	UN	755	LGH
6/6/2002	M	UN	825	P
6/10/2002	M	AD	678	P
6/11/2002	F	AD	723	P
6/11/2002	M	AD	734	P
6/11/2002	M	UN	659	P
6/11/2002	F	UN	684	P
6/11/2002	M	UN	734	LGH
6/12/2002	F	AD	638	P
6/12/2002	F	AD	685	P
6/12/2002	M	AD	717	P
6/12/2002	F	AD	721	P
6/12/2002	F	AD	736	P
6/12/2002	M	AD	755	P
6/12/2002	F	UN	814	LGH
6/13/2002	M	AD	628	P
6/13/2002	M	AD	649	P
6/13/2002	F	AD	665	P
6/13/2002	F	AD	698	P
6/13/2002	M	AD	716	P
6/13/2002	F	AD	724	P
6/13/2002	M	AD	758	P
6/13/2002	F	UN	619	LGH
6/13/2002	F	UN	657	P
6/13/2002	M	UN	661	LGH
6/13/2002	F	UN	689	P
6/13/2002	F	UN	697	P
6/13/2002	F	UN	718	P
6/13/2002	F	UN	724	LGH

F = female, M = male, J = jack (3 yr old male), U = unknown
UN = unmarked, AD = adipose clip (hatchery-origin)
P = passed, LGH = transported to Lookingglass Hatchery and used as broodstock

Appendix Table 2 continued

Date	Sex	Marks	FL	Dispos
6/13/2002	M	UN	795	P
6/13/2002	M	UN	887	P
6/14/2002	F	AD	648	P
6/14/2002	M	AD	684	P
6/14/2002	M	AD	736	P
6/14/2002	J	UN	464	LGH
6/14/2002	J	UN	595	P
6/14/2002	J	UN	599	LGH
6/14/2002	M	UN	654	LGH
6/14/2002	M	UN	669	LGH
6/14/2002	M	UN	672	P
6/14/2002	F	UN	692	P
6/14/2002	M	UN	719	P
6/14/2002	F	UN	724	LGH
6/14/2002	M	UN	724	P
6/14/2002	M	UN	795	LGH
6/14/2002	M	UN	802	P
6/14/2002	M	UN	819	P
6/14/2002	M	UN	849	LGH
6/14/2002	M	UN	891	P
6/15/2002	M	AD	617	P
6/15/2002	M	AD	655	P
6/15/2002	F	AD	660	P
6/15/2002	F	AD	669	P
6/15/2002	F	AD	670	P
6/15/2002	M	AD	671	P
6/15/2002	F	AD	693	P
6/15/2002	F	AD	694	P
6/15/2002	F	AD	698	P
6/15/2002	F	AD	702	P
6/15/2002	F	AD	703	P
6/15/2002	F	AD	703	P
6/15/2002	M	AD	704	P
6/15/2002	M	AD	709	P
6/15/2002	F	AD	721	P
6/15/2002	M	AD	724	P
6/15/2002	M	AD	730	P
6/15/2002	F	AD	734	P
6/15/2002	F	AD	739	P
6/15/2002	M	AD	762	P
6/15/2002	F	AD	772	P
6/15/2002	M	AD	783	P
6/15/2002	F	AD	798	P
6/15/2002	M	AD	805	P
6/15/2002	J	UN	580	P

Date	Sex	Marks	FL	Dispos
6/15/2002	J	UN	583	LGH
6/15/2002	J	UN	615	P
6/15/2002	M	UN	630	P
6/15/2002	M	UN	655	P
6/15/2002	M	UN	674	P
6/15/2002	F	UN	686	P
6/15/2002	F	UN	694	P
6/15/2002	M	UN	710	P
6/15/2002	M	UN	720	P
6/15/2002	F	UN	725	LGH
6/15/2002	F	UN	735	LGH
6/15/2002	F	UN	738	LGH
6/15/2002	F	UN	739	P
6/15/2002	F	UN	748	LGH
6/15/2002	F	UN	750	P
6/15/2002	F	UN	775	P
6/15/2002	M	UN	780	P
6/15/2002	M	UN	827	P
6/15/2002	M	UN	830	P
6/15/2002	M	UN	835	P
6/15/2002	M	UN	835	P
6/15/2002	M	UN	842	P
6/15/2002	M	UN	885	LGH
6/15/2002	M	UN	898	LGH
6/15/2002	M	UN	932	P
6/17/2002	M	AD	637	P
6/17/2002	M	AD	660	P
6/17/2002	M	AD	660	P
6/17/2002	F	AD	670	P
6/17/2002	F	AD	671	P
6/17/2002	F	AD	675	P
6/17/2002	F	AD	680	P
6/17/2002	M	AD	688	P
6/17/2002	M	AD	694	P
6/17/2002	F	AD	695	P
6/17/2002	F	AD	701	M
6/17/2002	F	AD	702	P
6/17/2002	M	AD	703	P
6/17/2002	M	AD	704	P
6/17/2002	F	AD	706	P
6/17/2002	F	AD	712	P
6/17/2002	M	AD	719	P
6/17/2002	F	AD	727	P
6/17/2002	M	AD	733	P
6/17/2002	M	AD	734	P

Appendix Table 2 continued

Date	Sex	Marks	FL	Dispos	Date	Sex	Marks	FL	Dispos
6/17/2002	F	AD	735	P	6/21/2002	F	AD	641	P
6/17/2002	F	AD	742	P	6/21/2002	F	AD	660	P
6/17/2002	F	AD	752	P	6/21/2002	F	AD	663	P
6/17/2002	M	AD	753	P	6/21/2002	F	AD	669	P
6/17/2002	M	AD	762	P	6/21/2002	M	AD	669	P
6/17/2002	M	AD	769	P	6/21/2002	F	UN	651	P
6/17/2002	M	AD	773	P	6/21/2002	F	UN	684	P
6/17/2002	M	AD	825	P	6/21/2002	F	UN	744	P
6/17/2002	J	UN	559	P	6/21/2002	F	UN	802	P
6/17/2002	M	UN	600	LGH	6/21/2002	F	UN	886	P
6/17/2002	J	UN	610	P	6/22/2002	J	AD	556	P
6/17/2002	M	UN	644	P	6/22/2002	F	AD	645	P
6/17/2002	M	UN	655	P	6/22/2002	M	AD	724	P
6/17/2002	J	UN	660	P	6/22/2002	M	AD	725	P
6/17/2002	M	UN	665	P	6/22/2002	M	AD	739	P
6/17/2002	M	UN	673	P	6/22/2002	F	UN	665	P
6/17/2002	F	UN	685	P	6/22/2002	F	UN	725	P
6/17/2002	F	UN	694	P	6/22/2002	M	UN	879	P
6/17/2002	M	UN	697	P	6/24/2002	J	AD	460	P
6/17/2002	M	UN	702	P	6/24/2002	J	AD	541	P
6/17/2002	M	UN	708	P	6/24/2002	F	AD	658	P
6/17/2002	M	UN	711	LGH	6/24/2002	M	AD	661	P
6/17/2002	F	UN	719	P	6/24/2002	F	AD	664	P
6/17/2002	M	UN	722	P	6/24/2002	F	AD	666	P
6/17/2002	M	UN	735	P	6/24/2002	M	AD	669	P
6/17/2002	F	UN	744	LGH	6/24/2002	M	AD	703	P
6/17/2002	M	UN	745	P	6/24/2002	M	AD	721	P
6/17/2002	M	UN	759	P	6/24/2002	M	AD	724	P
6/17/2002	F	UN	768	P	6/24/2002	F	AD	726	P
6/17/2002	F	UN	785	P	6/24/2002	F	AD	743	P
6/17/2002	F	UN	787	LGH	6/24/2002	M	UN	638	P
6/17/2002	M	UN	854	LGH	6/24/2002	F	UN	664	P
6/17/2002	F	UN	870	LGH	6/24/2002	M	UN	667	P
6/17/2002	M	UN	911	LGH	6/24/2002	M	UN	677	P
6/18/2002	M	UN	923	P	6/24/2002	M	UN	702	P
6/19/2002	J	AD	650	P	6/24/2002	F	UN	705	P
6/19/2002	F	AD	661	P	6/24/2002	F	UN	711	P
6/19/2002	M	AD	722	P	6/24/2002	F	UN	722	P
6/19/2002	F	AD	728	P	6/24/2002	M	UN	742	P
6/19/2002	F	UN	665	P	6/24/2002	M	UN	763	P
6/19/2002	F	UN	729	P	6/24/2002	M	UN	769	P
6/20/2002	J	AD	459	P	6/24/2002	F	UN	860	LGH
6/20/2002	M	AD	759	P	6/25/2002	J	AD	465	P
6/20/2002	F	UN	658	P	6/25/2002	J	AD	555	P
6/21/2002	J	AD	424	P	6/25/2002	F	AD	685	P

Appendix Table 2 continued

Date	Sex	Marks	FL	Dispos
6/25/2002	M	AD	696	P
6/25/2002	M	AD	764	P
6/26/2002	M	AD	683	P
6/26/2002	F	AD	695	P
6/26/2002	M	UN	842	P
6/27/2002	J	AD	436	P
6/27/2002	F	AD	654	P
6/27/2002	M	AD	739	P
6/27/2002	M	UN	944	LGH
6/28/2002	J	AD	435	P
6/28/2002	F	AD	638	P
6/28/2002	F	AD	690	P
6/28/2002	M	UN	654	P
6/28/2002	M	UN	698	P
6/28/2002	F	UN	728	P
6/28/2002	M	UN	825	P
6/28/2002	M	UN	900	P
6/29/2002	M	AD	705	P
6/29/2002	F	UN	875	P
7/1/2002	J	AD	484	P
7/1/2002	F	AD	664	P
7/1/2002	F	AD	700	P
7/1/2002	F	AD	706	P
7/1/2002	M	AD	741	P
7/1/2002	F	UN	698	P
7/1/2002	M	UN	892	P
7/6/2002	J	UN	408	P
7/6/2002	F	UN	739	P
7/8/2002	F	AD	670	P
7/8/2002	M	AD	746	P
7/8/2002	M	UN	771	P
7/8/2002	M	UN	771	P
7/8/2002	F	UN	825	P
7/11/2002	M	AD	747	P
7/11/2002	M	UN	637	WM
7/12/2002	M	AD	815	P
7/12/2002	F	UN	712	P
7/13/2002	M	UN	728	P
7/13/2002	M	UN	735	P
7/15/2002	M	UN	732	LGH
7/16/2002	M	UN	836	P
7/17/2002	F	AD	686	P
7/31/2002	M	UN	741	P

Appendix Table 3. Data for summer steelhead collected at the upper Grande Ronde River weir in 2002.

Date	Sex	Mark	FL	MigStat	Disp
4/24/02	F	UN	665	UPS	P
4/24/02	M	UN	645	UPS	P
4/25/02	F	UN	673	UPS	P
4/26/02	F	UN	579	UPS	P
4/26/02	M	UN	595	UPS	P
4/26/02	M	UN	606	UPS	P
4/26/02	M	UN	621	UPS	P
4/26/02	F	UN	610	UPS	P
4/26/02	F	UN	630	UPS	P
4/27/02	M	UN	703	UPS	P
4/27/02	M	UN	550	UPS	P
4/27/02	F	UN	569	UPS	P
4/29/02	F	UN	575	UPS	P
4/29/02	F	UN	614	UPS	P
4/29/02	F	UN	622	UPS	P
4/29/02	F	UN	743	FB	M
4/30/02	F	UN	625	UPS	P
5/1/02	M	UN	659	UPS	P
5/2/02	F	LV	695	FB	M
5/3/02	F	UN	623	UPS	P
5/3/02	F	UN	731	UPS	P
5/5/02	F	UN	650	UPS	P
5/5/02	F	UN	600	UPS	P
5/8/02	F	UN	555	UPS	P
5/13/02	F	UN	557	UPS	P
5/13/02	F	UN	555	UPS	P
5/13/02	M	UN	627	UPS	P
5/13/02	F	UN	605	UPS	P
5/13/02	M	UN	555	UPS	P
5/14/02	F	UN	602	UPS	P
5/14/02	M	UN	549	UPS	P
5/14/02	F	UN	718	UPS	P
5/14/02	F	UN	700	FB	M
5/15/02	M	UN	655	UPS	P
5/17/02	F	UN	702	FB	M
5/17/02	F	UN	605	UPS	P
5/18/02	M	UN	725	FB	M
5/19/02	M	UN	720	FB	M
5/22/02	F	UN	567	FB	M
5/23/02	F	UN	580	UPS	P
5/23/02	F	UN	631	UPS	P
5/24/02	F	UN	770	FB	M
5/26/02	F	UN	584	UPS	P
5/26/02	M	UN	757	FB	M
5/30/02	F	UN	690	FB	M
5/30/02	M	UN	632	FB	M
6/2/02	M	UN	645	FB	M
6/2/02	F	UN	610	FB	M
6/3/02	M	UN	625	FB	M
6/3/02	F	UN	705	FB	M
6/4/02	M	UN	628	FB	M
6/4/02	M	UN	630	FB	M
6/4/02	M	UN	652	FB	M
6/4/02	F	UN	695	FB	M
6/4/02	M	UN	633	FB	M
6/6/02	M	UN	612	FB	M
6/6/02	M	UN	591	UPS	P
6/7/02	F	UN	670	FB	M
6/7/02	F	UN	630	FB	M
6/7/02	M	UN	642	FB	M
6/10/02	F	UN	580	FB	M
6/11/02	F	UN	618	FB	M
6/13/02	F	UN	605	FB	M
6/14/02	M	UN	700	FB	M

F = female, M = male, U = unknown
UN = unmarked, LV = left ventral clip (hatchery-origin)
UPS = upstream-migrating, FB = fallback (kelt)
P = passed, M = mortality

Appendix Table 4. Data for spring chinook collected at the upper Grande Ronde River weir in 2002.

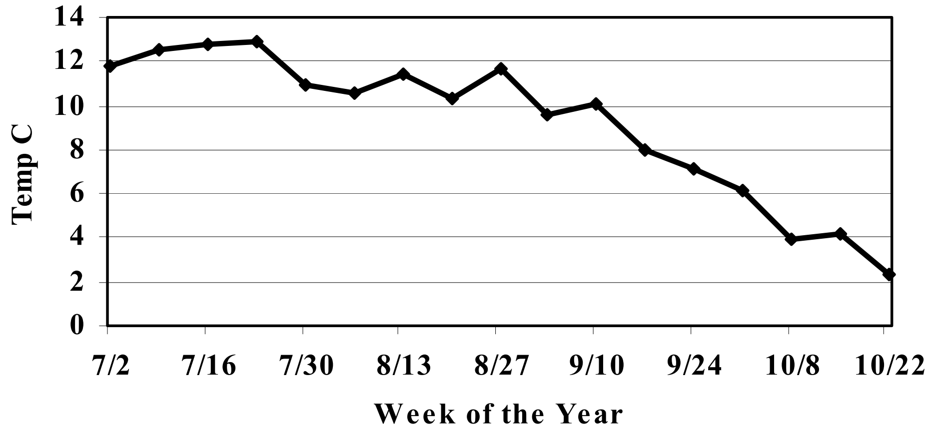
Date	Sex	Mark	FL	Dispos
5/30/2002	M	UN	707	P
6/1/2002	M	UN	879	LGH
6/2/2002	M	UN	756	P
6/3/2002	F	UN	731	P
6/3/2002	M	UN	875	LGH
6/3/2002	M	UN	728	P
6/4/2002	F	UN	717	LGH
6/4/2002	F	UN	674	P
6/4/2002	F	UN	837	LGH
6/4/2002	F	UN	695	P
6/5/2002	F	AD	711	P
6/5/2002	M	UN	805	LGH
6/5/2002	F	UN	678	LGH
6/5/2002	F	UN	836	P
6/5/2002	F	UN	724	LGH
6/5/2002	F	UN	750	P
6/5/2002	M	UN	768	P
6/5/2002	M	UN	860	LGH
6/5/2002	F	UN	805	LGH
6/5/2002	F	UN	710	P
6/5/2002	M	UN	690	P
6/5/2002	F	UN	675	LGH
6/6/2002	F	UN	861	P
6/6/2002	M	UN	795	LGH
6/6/2002	M	UN	680	P
6/7/2002	M	UN	878	LGH
6/7/2002	F	UN	822	LGH
6/7/2002	F	UN	683	P
6/7/2002	F	UN	750	LGH
6/7/2002	M	UN	728	P
6/7/2002	F	UN	810	P
6/7/2002	M	UN	735	LGH
6/8/2002	F	UN	682	LGH
6/10/2002	M	UN	764	P
6/11/2002	M	UN	760	LGH
6/13/2002	M	UN	892	P
6/13/2002	F	UN	651	P
6/13/2002	M	UN	798	LGH
6/13/2002	F	UN	728	LGH
6/13/2002	M	UN	649	P
6/13/2002	M	UN	711	LGH
6/13/2002	M	UN	681	P
6/14/2002	M	UN	901	LGH
6/14/2002	F	UN	820	P
6/14/2002	F	UN	730	LGH

Date	Sex	Mark	FL	Dispos
6/14/2002	F	UN	739	P
6/14/2002	F	UN	716	LGH
6/14/2002	F	UN	863	P
6/16/2002	F	AD	696	P
6/16/2002	M	UN	897	P
6/16/2002	F	UN	735	P
6/16/2002	M	UN	744	P
6/16/2002	M	UN	749	LGH
6/16/2002	M	UN	735	P
6/16/2002	F	UN	663	LGH
6/16/2002	F	UN	690	P
6/16/2002	M	UN	722	P
6/16/2002	M	UN	775	LGH
6/16/2002	F	UN	902	LGH
6/16/2002	F	UN	800	P
6/16/2002	M	UN	725	LGH
6/17/2002	F	AD	747	P
6/17/2002	F	UN	720	LGH
6/17/2002	F	UN	709	P
6/18/2002	M	UN	700	P
6/18/2002	M	UN	711	LGH
6/18/2002	M	UN	882	P
6/19/2002	F	UN	680	LGH
6/19/2002	F	UN	849	P
6/19/2002	F	UN	673	LGH
6/20/2002	M	UN	706	LGH
6/20/2002	F	UN	666	P
6/21/2002	F	UN	711	LGH
6/21/2002	F	UN	695	P
6/21/2002	F	UN	705	LGH
6/21/2002	F	UN	660	P
6/21/2002	F	UN	790	LGH
6/23/2002	M	UN	768	P
6/23/2002	M	UN	730	LGH
6/23/2002	M	UN	801	P
6/23/2002	M	UN	702	LGH
6/23/2002	J	UN	503	LGH
6/23/2002	F	UN	669	P
6/25/2002	M	UN	843	P
6/25/2002	M	UN	906	LGH
6/25/2002	M	UN	736	P
6/27/2002	M	UN	700	LGH
6/28/2002	M	UN	907	P
6/30/2002	M	UN	770	LGH
6/30/2002	M	UN	670	P

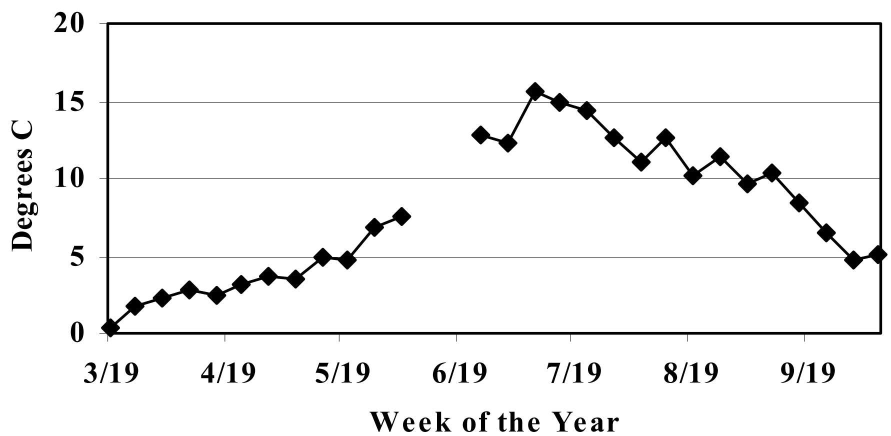
F = female, M = male, J = jack (3 yr old male), U = unknown
UN = unmarked, AD = adipose clip (hatchery-origin)
P = passed, LGH = transported to Lookingglass Hatchery and used as broodstock, M = weir mortality

Appendix Table 4 continued

Date	Sex	Mark	FL	Dispos
6/30/2002	M	UN	712	LGH
6/30/2002	F	UN	694	LGH
7/7/2002	M	UN	759	P
7/9/2002	M	UN	657	LGH
7/9/2002	F	UN	845	P
7/9/2002	F	UN	674	LGH
7/11/2002	F	UN	822	P
7/11/2002	M	UN	901	LGH
7/12/2002	F	UN	690	LGH
7/12/2002	F	UN	780	P
7/12/2002	M	UN	785	P
7/12/2002	M	UN	692	LGH
7/12/2002	M	UN	698	P
7/13/2002	F	UN	765	M
7/13/2002	F	UN	700	M



Appendix Figure 1. Average weekly maximum water temperatures recorded during 2002 at the gauging station in North Fork Catherine Creek. (Gauge #13319900 operated by U. S. Forest Service and located about 4.8 km upstream of acclimation facility).



Appendix Figure 2. Average weekly maximum water temperatures recorded during 2002 at the gauging station in the upper Grande Ronde River just below mouth of Clear Creek. (Gauge #13317850 operated by U. S. Forest Service and located about 1.6 km upstream of acclimation facility).